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SELECTION OF A TEXTILE BINDER APPLICATION METHOD FOR A NEW TEXTILE PROCESS

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ABSTRACT

The textile sector has been developing new alternative textile processes, which need to increase the performed research in this area, for the identification of optimal methodologies for the manufacture of textile products with specific technical characteristics. This research presents the procedure used for the selection of a textile binder application methodology, relevant process in the manufacturing of non-woven textiles. This method has to assure the formation of a homogenous and consistent film of binder over the fibers that permits the application of subsequent processes. The following application methods were evaluated: (1) Pistol-pistol, (2) sheet-pistol and (3) submersion.

KEYWORDS: Application Method, Textile Binder, Methodology, Pistol, Sheet & Submersion

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Original Article

INTRODUCTION

Non-woven textiles are characterized for being plain sheets obtained through the consolidation of fibers or filaments, which can be interlaced mechanically, thermally or chemically, without going through textile traditional spinning and weaving processes. (INDA, 2017). The application of this textile genre is reduced in the textile industry due to the empirical development of new alternative textile processes. In this situation, a new research for the technification of a new non-woven textile process; which can work with animal, vegetal and synthetic fibers; is being developed. For the adequate cohesion and compaction between fibers, a textile binder (a substance capable of adhering to the fibers and form a film over them) is used (Lockuan, 2012). On a previous research, the optimal textile binder (Arkofil) was selected, being this a polyvinyl alcohol polymer with medium viscosity (Toro, Pardo Figueroa & Larico, 2017) and (Achroma Management LLC, 2014). However, the need for the selection of the optimal application methodology arose, one which will be able to completely cohere the fibers for subsequent processes, without any impairment or delay.

The determination of the three methods selected for the laboratory tests (pistol-pistol, sheet-pistol and submersion) were made based on interviews with experts. The pistol-pistol method carried out using a textile degumming gun whose function is the dispersion of the textile binder uniformly in both sides of the sheet of fiber. The sheet-pistol method, which also uses the degumming gun, is carried on by applying the textile binder over a formed sheet (fibers covered by a polyester hollow fabric called can-can) so it can impregnate the fibers through it. Lastly, the submersion methodology consists of submerging the fiber sheet in a recipient filled with textile binder, and applying a slight manual pressure over the textile sheet so it absorbs the binder.

The selection of this methodology requires the performance of test that assure the validity of the results. The objective of this research was to determine the most optimal methodology for the application of the textile

binder, through an election based on experimental laboratory tests.

METHODOLOGY

Considerations

For the determination of the optimal application methodology, pilot tests were performed having in account the following considerations:

- 04 different kinds of combed fibers were used: baby alpaca, coarse alpaca, acrylic and jute.
- Textile sheets of 20 x 20 centimeters were formed as representative samples of the product of the new textile process.
- According to the information gathering and the expert consulting, three methodologies were proposed for evaluation: pistol-pistol, sheet-pistol and submersion.
- For the evaluation of the three proposed methodology, a matrix was formed considering three representatives samples for each kind of fiber, having a total of thirty six 20 x 20-fiber sheets.
- According to the information gathering and the expert consulting, it was determined that the controlled variables during the productive process were the following: kind of fiber, preparation time 1 (s), assembly time (s), initial weight (g), quantity of textile binder (ml), textile binder application time (s), textile binder drying time (s), weight with textile binder (g), time of application of the non-woven technique (s), weight after the technique (g), textile binder removing time (s), weight with water (g), final drying time (s) and final weight (g).
- The characteristics of the degumming gun can be seen in table N°01.
- The characteristics of the textile binder can be seen in table N°02.
- Three factors were considered for the selection of the application methodology: cycle time, quantity of textile binder and fiber behavior.

Table 1: Technical Specifications of the Degumming Gun

Textile degumming pistol		
Name	Arrow Spray Gun	
Model	YH – 170	
Weight allowed	1.2 kg to 1.7 kg	
Voltage	220 V	

Source: *data sheet*

Table 2: Arkofil Technical Specifications

Arkofil	
Appearance	White
Physical state	Granulated
Ionic character	Non-ionic
Ph	4.5 –7(4% active on neutral water)
Fusion temperature	160 – 200 °C
Boiling temperature	400°C
Density	1.25 g/cm^3 (20°C)
Water solubility	Soluble a 20°C

***Source**: data sheet*

Pilot Tests

The tests consisted of assembling textile sheets with coarse alpaca, baby alpaca, jute and acrylic fibers, apply the textile binder, submit them to the non-woven production process and remove the textile binder from the non-woven fabric obtained.

Pistol-Pistol Methodology

Assembly

The raw material was prepared and 20 x 20 sheets of fiber were made, controlling 04 variables: kind of fiber, preparation time (time in seconds for the preparation of the jute fibers, for this fibers were acquired as ropes and must be frayed for them to be suitable for the process), assembly time and initial weight.

Textile Binder Application

Pistol-pistol

This stage consists in the application of Arkofil for the temporal cohesion of the fiber sheet obtained in the assembly, using the pistol described in table N° 1. The application is made in both sides of the sheets controlling 02 variables: quantity of textile binder and application time. (pistol-pistol)

Sheet-pistol

This stage consists in the application of Arkofil for the temporal cohesion of the fiber sheet obtained in the assembly by using can-can surfaces over which the textile binder is applied with the pistol described in table 1. This application is done on both sides of the textile sheet controlling 02 variables: quantity of textile binder and application time.

Submersion

This stage consists of the application of Arkofil for the temporal cohesion of the fiber sheet obtained in the assembly, by placing the sheets inside a plastic tray and pouring the liquid Arkofil over them until they are completely wet. During this test 02 variables were controlled: quantity of textile binder and application time.

Textile Binder Drying

Once the textile binder has been applied, the textile sheets are introduced into a dryer until they completely dry. In this stage, 02 variables were controlled: textile binder drying time and weight with textile binder.

Application of the Non-Woven Technique

Having the compact 20 x 20 centimeters sheets of fibers, they are subject to the non-woven technique. The sheets obtained in the last process must have uniform surfaces for this process to be optimal. The controlled variables are time of application of the non-woven technique and weight after the technique.

Textile Binder Removal

This stage consists of the elimination of the textile binder from the cohered textile sheet, by using water to wash it off. To do this process firstly the sheet is left soaking in water for ten minutes, then it is softly squeezed and spin-dried, and

finally it is left to dry. Once the textile sheet has dried the excess loose fiber from the borders is removed (cut with scissors). The controlled variables in this process are textile binder removing time, weight with water, final drying time and final weight.

The results of the tests with the different textile binder applications can be seen in table N°03

Table 3: Results Table

Results table														
Technique	**Fiber**	**Preparation time (s)**	**Assembly time (s)**	**Initial weight (gr)**	**Quantity of textile binder (ml)**	**Textile binder application time (s)**	**Textile binder drying time (s)**	**Weight with textile binder (g)**	**Time of application of the non-woven technique (s)**	**Weight after the technique (g)**	**Textile binder removing time (s)**	**Weight with water (g)**	**Final drying time (s)**	**Final weight (g)**
Pistol-pistol	Coarse alpaca	-	410.00	14.94	21.50	1218.33	7680	15.32	130	15.92	1088.93	17.44	1500	11
	Baby alpaca	-	245.33	9.76	20.42	1233.67	7680	10.95	130	11.14	1087.62	12.41	1500	7.45
	Acrylic	-	415.00	11.56	26.95	1184.67	6300	12.70	130	13.23	1087.75	14.47	1500	8.91
	Jute	12636	1054.33	13.25	24.56	1305.00	6300	14.91	130	15.12	1090.34	21.43	1500	10.95
Sheet-pistol	Coarse alpaca	-	423.33	14.94	35.59	175.33	10440	17.30	130	17.53	1086.78	18.21	1260	10.87
	Baby alpaca	-	341.33	9.74	28.06	177.33	10440	11.57	130	11.78	1084.56	11.81	1260	7.31
	Acrylic	-	452.33	11.57	27.76	157.67	10440	13.45	130	13.76	1085.17	15.23	1260	9.64
	Jute	12874.33	1057.67	13.29	36.22	145.33	10440	15.77	130	16.10	1084.51	21.80	1260	10.32
Submersion	Coarse alpaca	-	376.33	14.95	50.93	383.33	11220	18.78	130	18.99	1088.63	19.74	1260	10.40
	Baby alpaca	-	279.33	9.78	29.33	356.00	11220	12.12	130	12.36	1088.60	14.00	1260	7.45
	Acrylic	-	464.67	11.54	46.67	168.67	11220	14.77	130	16.67	1089.13	14.88	1260	8.43
	Jute	12708	1040.00	13.25	53.07	285.67	11220	16.76	130	18.41	1086.65	23.00	1260	10.99

Source: Own elaboration

RESULTS

Having executed the process for obtaining non-woven textile for the three types of textile binder application methods, the data collected from each of them have been analyzed were obtained the following results:

- The lead-time of the pistol-pistol method is approximately 3.20 hours, the pistol-sheet method is 3.80 hours and the submersion method is 4 hours.
- The quantity of textile binder used through the pistol-pistol method is 23.36 ml average, for the sheet-pistol method, 31.91 ml average and for the submersion method is 45 ml average.
- The compaction required in the textile binder application stage must reach a point where the sheet does not show any deformities during the application of the non-woven technique and the textile binder removal. In the pistol-pistol methodology the fibers did not cohere completely, for there were sheets that were damaged during the non-woven technique application; additionally, the application by both sides with the pistol caused the appearance of indentations in the sheet, which made the application of subsequent processes more difficult. The pistol-sheet methodology achieves the complete cohesion of the sheet, which was enough for it to be processed. The submersion method attained the required cohesion, but the textile sheet was deformed, obtaining a thinner and larger sheet; furthermore, it requires a greater effort in to remove the textile binder.

Table 04 shows us the factors for the selection of the methodology; and, the results in the selection of the most optimal method (sheet-pistol) were made through factor weighting, which can be seen in table N° 05.

Table 4: Factor Weighting for the Selection of the Textile Binder Application Methodology

Factors	Lead time	Quantity of textile binder	Fiber behavior	Total	Weight
Lead time	3	3	2	8	0.30
Quantity of textile binder	3	3	2	8	0.30
Fiber behavior	4	4	3	11	0.40
Total				**27**	**1.00**

Note: The qualification was made having in consideration the following values: 1-Much less important than, 2-Less important than, 3- As important as, 4- More important than, and 5-Much more important than.

Source: *Own elaboration*

Table 5: Evaluation and Selection of the Methodology for the Application of Textile Binder in the Non-Woven Textile Manufacturing Process

Factors/Methodology	Peso	Pistol-pistol	Sheet-pistol	Submerssion
Lead time	0.30	5	3	1
Quantity of textile binder	0.30	1	3	5
Fiber behavior	0.40	1	5	3
Total	**1.00**	**2.2**	**3.8**	**3**

Note: The qualification was made having in consideration the following values: 1- Deficient, 2- Bad, 3-Standard,4-Good, and 5-Excelent.

Source: Own elaboration

CONCLUSIONS

- The textile binder application methodologies can be changed independently without drastically changing subsequent processes.
- Even though the submersion methodology reaches the necessary fiber cohesion, the deformation of the sheet of fiber during the process discards this methodology.
- The most optimal application methodology selected was the sheet-pistol method, because is lead-time and quantity of textile binder allowed us to obtain an adequate fiber cohesion, having a product without deformities.

REFERENCES

1. *Association of the Nonwoven Fabrics Industry, INDA (2017). About Nonwovens. Retrieved on november 3rd, 2017 fromhttp://www.inda.org/about-inda/*
2. *Lockuán Lavado, F. E. (2012). La industria textil y su control de calidad, IV. Tejeduría (pp. 8-14). Retrieved on november 2nd, 2017 fromhttp://fidel-lockuan.webs.com*
3. *Archroma Management LLC (2014). Technical information Arkofil FVJ Gran*
4. *S. Jayapriya & G. Bagyalakshmi, Textile Antimicrobial Testing and Standards, International Journal of Textile and Fashion Technology (IJTFT), Volume 4, Issue 1, January - February 2014, pp. 1-10*
5. *Toro, Pardo Figueroa & Larico (2017), Methodology for the selection of Chemical Textile Products. International Journal of Textile and Fashion Technology.*